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REINFORCING BAR COUPLER

Technical Field

The present invention relates, in general, to reinforcing bar couplers and, more particularly, to a reinforcing bar coupler which is designed to couple reinforcing bars in a mechanical coupling method when the reinforcing bars are to be coupled to each other in reinforced concrete work, thus ensuring a prompt and easy coupling operation and allowing the reinforcing bars to be firmly coupled to each other.

Background Art

There have been used various methods of jointing reinforcing bars, for example, a lap-joint process, a gas pressure welding process, a thread-joint process, etc. Of these, the lap-joint process, which is carried out in such a way that ends of reinforcing bars are lapped along certain lengths thereof and the lapped ends are bound with binding wires, is predominantly used. However, the lap-joint process has a disadvantage in that the lapped reinforcing bars are weakened in resistance to a tensile load. Further, the gas pressure welding process is carried out as follows. That is, ends of reinforcing bars are butted on each other and the ends of the reinforcing bars

are welded to each other through oxy acetylene welding. However, the gas welding process is problematic in that it is complicated and takes a longer time to execute the gas pressure welding process. Further, the welded portion of the reinforcing bars is weakened by heat, and a post inspection is further required. The thread-joint process is carried out as follows. A male thread is formed on an end of each reinforcing bar. The ends of the reinforcing bars are coupled to each other by a coupler having a female thread on an inner surface thereof. However, the thread-joint process has a problem in that the ends of the reinforcing bars must be threaded and the long reinforcing bars must be coupled to each other in a screw-type fastening method while being aligned with each other, so that it is difficult to execute the thread-joint process. The thread-joint process has another problem in that a part having the thread of each reinforcing bar has a smaller diameter compared to a remaining part of each reinforcing bar, so that the part having the thread is weakened in resistance to the tensile load.

Disclosure of the Invention

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a mechanical reinforcing bar coupler which includes a sleeve,

a cover unit, and a wedge, so that reinforcing bars are coupled to each other by fitting only the wedge into the sleeve using a simple hammering tool or a hydraulic tool, thus ensuring prompt and easy coupling operation, and allowing the reinforcing bars to be firmly coupled to each other. Further, the sleeve is axially opened at a surface thereof to form an opening, so that a worker executes the coupling operation while observing an interior of the sleeve with the naked eye, thus the coupling operation is more promptly and conveniently carried out. Further, it is possible to manufacture elements of the reinforcing bar coupler by a steel plate using a pressing machine, thus allowing mass production of the reinforcing bar coupler and thereby considerably reducing costs of the reinforcing bar coupler.

Another object of the present invention is to provide a mechanical reinforcing bar coupler which allows the reinforcing bars to be coupled to each other while being lapped, thus affording a prompt and convenient coupling operation, having higher resistance to a tensile or compressive load compared to a lap-joint process using binding wires, and allowing the length of lapped regions of the reinforcing bars to be shorter and thereby increasing distances between adjacent coupled reinforcing bars, therefore allowing concrete pouring operation to be easily executed.

A further object of the present invention is to

provide a reinforcing bar coupler which allows elements of the reinforcing bar coupler to be manufactured without an additional process, such as a threading process, thus reducing manufacturing costs of the reinforcing bar coupler.

A still another object of the present invention is to provide a reinforcing bar coupler capable of coupling reinforcing bars which may have little difference in the size of the reinforcing bars according to manufacturing companies in spite of the same standard, if only the reinforcing bars have the latitudinal ribs of the same shape regardless of whether the latitudinal ribs of the reinforcing bars have a circular or semicircular shape.

In order to accomplish the above objects, the present invention provides a reinforcing bar coupler including a cylindrical sleeve which is opened at a surface thereof, and has a first seating groove axially provided in the sleeve so that ends of reinforcing bars are seated therein and a pair of first locking parts each having a first slant surface, and including a cover unit which has a second seating groove axially provided in the cover unit to cover the reinforcing bars seated in the first seating groove of the sleeve, and including a wedge which has a pair of second locking parts each having a second slant surface. In this case, the wedge is axially fitted into the sleeve to be placed between the first locking parts of the sleeve and the cover unit, so that the wedge wedges the cover unit and

the reinforcing bars in the sleeve, thus allowing the reinforcing bars to be firmly coupled to each other.

Brief Description of the Drawings

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of a reinforcing bar coupler, according to a first embodiment of the present invention;

FIG. 2 is a side view of the reinforcing bar coupler of FIG. 1, in which two reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 3 is a sectional view taken along the line C-C of FIG. 2;

FIG. 4 is a sectional view taken along the line D-D of FIG. 2;

FIG. 5 is a perspective view of the reinforcing bar coupler of FIG. 1, when the reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 6 is a sectional view taken along the line C-C of FIG. 2 showing a reinforcing bar coupler according to a modification of the first embodiment, in which the reinforcing bar coupler includes an additional rib seat between rib seats of a sleeve, and an additional rib seat

between rib seats of a cover unit;

FIG. 7 is an exploded perspective view of a reinforcing bar coupler, according to a second embodiment of the present invention;

FIG. 8 is a perspective view of a wedge included in the reinforcing bar coupler of FIG. 7;

FIG. 9 is a side view of the reinforcing bar coupler of FIG. 7 when shown from a leading end of the wedge, in which two reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 10 is a sectional view taken along the line E-E of FIG. 9;

FIG. 11 is a perspective view of the reinforcing bar coupler of FIG. 7, when the reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 12 is a perspective view of the reinforcing bar coupler of FIG. 7, when the reinforcing bars are coupled to each other by a plurality of reinforcing bar couplers;

FIG. 13 is a side view of a reinforcing bar coupler according to a modification of the second embodiment, in which locking parts of a sleeve and locking parts of a cover unit extend outward, different from the reinforcing bar coupler of FIG. 7;

FIG. 14 is an exploded perspective view of a reinforcing bar coupler, according to a third embodiment of the present invention;

FIG. 15 is a perspective view of a wedge included in

the reinforcing bar coupler of FIG. 14;

FIG. 16 is a perspective view of a wedge included in a reinforcing bar coupler according to a modification of the third embodiment, in which the wedge has a shape different from the wedge of FIG. 15;

FIG. 17 is a side view of the reinforcing bar coupler of FIG. 14 when shown from a hammering end of the wedge, in which two reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 18 is a sectional view taken along the line G-G of FIG. 17;

FIG. 19 is a sectional view taken along the line H-H of FIG. 17;

FIG. 20 is an exploded perspective view of a reinforcing bar coupler, according to a fourth embodiment of the present invention;

FIG. 21 is a side view of the reinforcing bar coupler of FIG. 20, when the reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 22 is a sectional view taken along the line A-A of FIG. 21;

FIG. 23 is a perspective view of the reinforcing bar coupler of FIG. 20, when the reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 24 is a sectional view taken along the line A-A of FIG. 21 showing a reinforcing bar coupler according to a modification of the fourth embodiment, in which the

reinforcing bar coupler is used to couple deformed bars having semicircular ribs to each other;

FIG. 25 is an exploded perspective view of a reinforcing bar coupler, according to a fifth embodiment of the present invention;

FIG. 26 is a side view of the reinforcing bar coupler of FIG. 25, when two reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 27 is a sectional view taken along the line B-B of FIG. 26;

FIG. 28 is a perspective view of the reinforcing bar coupler of FIG. 25, when the reinforcing bars are coupled to each other by the reinforcing bar coupler;

FIG. 29 is a sectional view taken along the line B-B of FIG. 26 showing a reinforcing bar coupler according to a first modification of the fifth embodiment, in which the reinforcing bar coupler is used to couple deformed bars having semicircular ribs to each other;

FIG. 30 is a sectional view taken along the line B-B of FIG. 26 showing a reinforcing bar coupler according to a second modification of the fifth embodiment, in which the reinforcing bar coupler is used to couple the deformed bars having semicircular ribs to each other;

FIG. 31 is an exploded perspective view of a reinforcing bar coupler, according to a sixth embodiment of the present invention;

FIG. 32 is a perspective view of a wedge included in

the reinforcing bar coupler of FIG. 31;

FIG. 33 is a perspective view of a wedge included in a reinforcing bar coupler according to a modification of the sixth embodiment, in which the wedge has a shape different from that of the wedge of FIG. 32;

FIG. 34 is a side view of the reinforcing bar coupler of FIG. 31 when shown from a hammering end of the wedge, in which two reinforcing bars are coupled to each other by the reinforcing bar coupler; and

FIG. 35 is a sectional view taken along the line F-F of FIG. 34.

Best Mode for Carrying Out the Invention

Reference should now be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components.

FIGS. 1 through 6 show a reinforcing bar coupler, according to the first embodiment of the present invention. According to the first embodiment, first and second reinforcing bars 1 and 1a are coupled to each other so that ends of the first and second reinforcing bars 1 and 1a are lapped together, using a sleeve 2 which is opened at a surface thereof, a cover unit 3, and a single wedge 4.

The sleeve 2 has a shape of a cylinder which is axially opened at a surface thereof to form an opening 23.

A pair of seating grooves 24 are axially provided in the sleeve 2 to be arranged side by side, so that ends of the first and second reinforcing bars 1 and 1a are seated in the seating grooves 24 to be arranged side by side. Each of the seating grooves 24 has a semicircular cross-section and a depth corresponding to about a half of a diameter of each of the first and second reinforcing bars 1 and 1a. A plurality of rib seats 26 having a semicircular cross-section are provided on predetermined portions of the seating grooves 24 to allow latitudinal ribs 12 of each of the first and second reinforcing bars 1 and 1a to be seated therein.

Both sidewalls 25 of the sleeve 2 upwardly extend from outer edges of the seating grooves 24 to face each other. An interval between the sidewalls 25 is slightly longer than a distance between outside longitudinal ribs 11 of the first and second reinforcing bars 1 and 1a which are seated in the seating grooves 24, thus allowing the cover unit 3 to be easily seated in the sleeve 2.

Further, the sleeve 2 includes a pair of locking parts 27 to be locked to locking parts 45 of the wedge 4 which will be described later herein. Each of the locking parts 27 perpendicularly extends from the upper edge of the associated sidewall 25 to form a U-shaped cross-section. In this case, the locking parts 27 are not connected to each other, and a slant surface 29 is axially formed along an inner surface of each of the locking parts 27 to be in

contact with an associated slant surface 46 of the wedge 4 described later herein.

On an outer surface of the sleeve 2 are provided a plurality of latitudinal ribs 22 and longitudinal ribs 21 to have the same shapes as the latitudinal ribs 12 and longitudinal ribs 11 of the first and second reinforcing bars 1 and 1a, thus increasing adhesive force between the first and second reinforcing bars 1 and 1a and concrete.

The cover unit 3 is longer than the sleeve 2 by about a half of an interval between the latitudinal ribs 12 of each of the first and second reinforcing bars 1 and 1a. Further, the cover unit 3 is slightly narrower than the interval between the sidewalls 25 which upwardly extend from the outer edges of the seating grooves 24 to face each other, so that the cover unit 3 is easily seated in a space between the sidewalls 25 of the sleeve 2.

The cover unit 3 has, at a surface thereof, a pair of seating grooves 31 which are arranged side by side to correspond to the seating grooves 24 of the sleeve 2, thus covering and compressing outer surfaces of the first and second reinforcing bars 1 and 1a seated in the seating grooves 24. A parallel surface 33 is formed at a side opposite to the seating grooves 31. Further, a serrated surface 33a is formed on a predetermined portion of the parallel surface 33 to engage with a serrated surface 43a of the wedge 4, thus preventing the wedge 4 from being removed from the sleeve 2 after the first and second

reinforcing bars 1 and 1a are coupled to each other.

Further, a plurality of rib seats 32 are formed on the seating grooves 31 of the cover unit 3 to have the same shape as the rib seats 26 of the sleeve 2.

The wedge 4 is slightly longer than the cover unit 3 in length thereof, while being equal to the cover unit 3 in width thereof. The wedge 4 includes a parallel surface 43 which is in contact with the parallel surface 33 of the cover unit 3. The serrated surface 43a is formed on a predetermined portion of the parallel surface 43 to engage with the serrated surface 33a of the cover unit 3. One or more grooves 44 are axially formed along the parallel surface 43 to reduce a surface area contacting the parallel surface 33 of the cover unit 3, thus allowing the wedge 44 to be easily fitted into the sleeve 2 in such a way as to be placed between the cover unit 33 and the locking parts 27 of the sleeve 2. A flat middle section 47 is formed on a side opposite to the parallel surface 43 of the wedge 4. A pair of locking parts 45 extend from opposite sides of the middle section 47 to form a U-shaped cross-section, thus engaging with the locking parts 27 of the sleeve 2. A slant surface 46 is axially formed along an outer surface of each of the locking parts 45 to become thin in a direction from a first end to a second end of each of the locking parts 45, thus being in close contact with the slant surface 29 of each of the locking part 27 of the sleeve 2.

The operation of the reinforcing bar coupler

according to the first embodiment will be described in the following in detail.

First, the first and second reinforcing bars 1 and 1a are placed so that the ends of the first and second reinforcing bars 1 and 1a are lapped along certain lengths thereof. A worker holds and moves the sleeve 2 to receive the lapped ends of the first and second reinforcing bars 1 and 1a in the opening 23 of the sleeve 2. The first and second reinforcing bars 1 and 1a are seated in the seating grooves 24 of the sleeve 2. Next, the cover unit 3 is axially fitted into the sleeve 2 from an end of the sleeve 2 to cover the first and second reinforcing bars 1 and 1a. Thereafter, a leading end 41 of the wedge 4 is inserted into a space between the parallel surface 33 of the cover unit 3 and the locking parts 27 of the sleeve 2, and then a hammering end 42 of the wedge 4 is hammered using a tool, such as a hammer or a hydraulic jack. While the wedge 4 is fitted into the sleeve 2, the slant surfaces 29 of the locking parts 27 of the sleeve 2 are in close contact with the slant surfaces 46 of the locking parts 45 of the wedge 4, so that the wedge 4 compresses the cover unit 3 and the cover unit 3 strongly compresses the outer surfaces of the first and second reinforcing bars 1 and 1a, thus allowing the first and second reinforcing bars 1 and 1a to be firmly coupled to each other.

The reinforcing bar coupler, which couples reinforcing bars to each other in a lap-joint process, is

mainly used to couple reinforcing bars having a smaller diameter to each other. But, such a reinforcing bar coupler may be used to couple reinforcing bars having a larger diameter to each other during arrangement of bars. The reinforcing bar coupler of this invention is equal to a conventional reinforcing bar coupler, in that reinforcing bars are coupled to each other while ends of the reinforcing bars are lapped along certain lengths thereof. However, according to the present invention, the reinforcing bars are coupled to each other by the mechanical reinforcing bar coupler having the sleeve 2, the cover unit 3, and the wedge 4, different from the conventional reinforcing bar coupler using binding wires. Thus, the reinforcing bar coupler of this invention allows the coupling operation to be easily executed, thus reducing a working period. Further, the reinforcing bar coupler of this invention allows the overlap length of the coupled reinforcing bars to be reduced, thus reducing building costs. Since distances between adjacent coupled reinforcing bars are increased when the coupled reinforcing bars are arranged, it is possible to thickly, deeply, and evenly pour concrete into a mold fabricated with concrete molding panels, thus increasing strength of a reinforced concrete structure. Further, the reinforcing bar coupler of this invention allows the coupled part of the reinforcing bars to have higher resistance to tensile or compressive load, compared to the conventional reinforcing bar coupler which

couples the reinforcing bars with the binding wires.

FIG. 6 shows a reinforcing bar coupler, according to a modification of the first embodiment. Additional rib seats 26 are provided between the rib seats 26 of the seating grooves 24 of the sleeve 2, and additional rib seats 32 are provided between the rib seats 32 of the seating grooves 31 of the cover unit 3, thus allowing the latitudinal ribs 12 to be seated in the rib seats 26 and 32, regardless of whether the shape of latitudinal ribs 12 are circular or semicircular. In a detailed description, when the first and second reinforcing bars 1 and 1a are coupled to each other while the ends of the reinforcing bars 1 and 1a are lapped, the latitudinal ribs 12 of the first and second reinforcing bars 1 and 1a must be simultaneously seated in the rib seats 26 of the sleeve 2 and the rib seats 32 of the cover unit 3. In this case, the first and second reinforcing bars 1 and 1a may have the latitudinal ribs 12 of the same shape, such as the circular or semicircular shape, but one of the reinforcing bars 1 and 1a may have the latitudinal ribs 12 having the circular shape while the other reinforcing bar 1, 1a may have the latitudinal ribs 12 having the semicircular shape. However, the additional rib seats 26, 32 are provided between the rib seats 26, 32, thus allowing the latitudinal ribs 12 of the reinforcing bars 1 and 1a to be simultaneously seated in the rib seats 26 and 32.

FIGS. 7 through 13 show a reinforcing bar coupler,

according to the second embodiment of the present invention. The reinforcing bar coupler of the second embodiment is equal to that of the first embodiment, except that the first and second reinforcing bars 1 and 1a are coupled to each other by fitting only a wedge 4a into a sleeve 2a without using the cover unit 3.

The sleeve 2a has the same construction as that of the first embodiment. Further, additional rib seats 26 may be provided between rib seats 26 of seating grooves 24 of the sleeve 2a so as to receive the first and second reinforcing bars 1 and 1a having the latitudinal ribs 12 of various shapes, as shown in FIG. 6.

The wedge 4a has the same width and length as the wedge 4 of the first embodiment. But, according to the second embodiment, since the first and second reinforcing bars 1 and 1a are wedged in the sleeve 2a by only the wedge 4a without the cover unit 3, the wedge 4a is formed to be thicker than the wedge 4, thus allowing outer surfaces of the first and second reinforcing bars 1 and 1a to be sufficiently compressed.

A leading end 41 of the wedge 4a is chamfered so that the wedge 4a smoothly slides into the sleeve 2a while not being hindered by outer surfaces or the latitudinal ribs 12 of the first and second reinforcing bars 1 and 1a, when the wedge 4a is hammered into the sleeve 2a in which the first and second reinforcing bars 1 and 1a are seated. A serrated surface 43a is formed throughout a parallel surface 43

contacting with the first and second reinforcing bars 1 and 1a to directly compress the outer surfaces of the first and second reinforcing bars 1 and 1a. Further, as shown in FIG. 8, a projecting part having a cross-section of a right triangle is provided at a hammering end 42 of a middle section 47 of the wedge 4a so that the wedge 4a is not hindered by the outer surfaces of the first and second reinforcing bars 1 and 1a when the wedge 4a is hammered into the sleeve 2a.

FIG. 13 shows a reinforcing bar coupler, according to a modification of the second embodiment. The reinforcing bar coupler of FIG. 13 is the same as that of the second embodiment, except for the cross-sections of locking parts 27 of the sleeve 2a and locking parts 45 of the wedge 4a. In the reinforcing bar coupler of FIG. 13, the locking parts 27 of the sleeve 2a outwardly extend from upper edges of the sidewalls 25 to be perpendicular to the sidewalls 25. A slant surface 29 is formed along the lower surface of each of the locking parts 27 to be slanted upward in a direction from an outside edge to an inside edge of the lower surface of each locking part 27. The locking parts 45 of the wedge 4a extend outward from opposite sides of the middle section 47 and are bent downward, prior to being bent toward the serrated surface 43a to form a U-shaped cross-section. A slant surface 46 is formed along the upper surface of the inward extending part of each of the locking parts 45 to correspond to the slant surfaces 29 of the

sleeve 2a. The general construction and operation of the reinforcing bar coupler of FIG. 13 remain the same as those of the reinforcing bar coupler of the second embodiment.

The coupling method using the reinforcing bar coupler according to the second embodiment is as follows.

First, the first and second reinforcing bars 1 and 1a are seated side by side in the seating grooves 24 of the sleeve 2a while the ends of the first and second reinforcing bars 1 and 1a being lapped along certain lengths thereof. Next, the wedge 4a is loosely inserted into the sleeve 2a to be placed between the first and second reinforcing bars 1 and 1a seated in the sleeve 2a and the locking parts 27, and then is hammered using a hammering tool. At this time, the slant surfaces 29 of the sleeve 2a come into close contact with the slant surfaces 46 of the wedge 4a so that the serrated surface 43a of the wedge 4a strongly compresses the outer surfaces of the first and second reinforcing bars 1 and 1a, thus allowing the first and second reinforcing bars 1 and 1a to be firmly coupled to each other.

The reinforcing bar coupler of the second embodiment may be used to couple reinforcing bars to each other while ends of the reinforcing bars being lapped, in place of binding wires. The reinforcing bar coupler of the second embodiment has more excellent workability and allows the reinforcing bars to be more firmly coupled to each other, in comparison with the coupling operation using the binding

wires. Further, one or more reinforcing bar couplers may be installed at overlap portions of the reinforcing bars, as shown in FIG. 12. As such, the number of the reinforcing bar couplers may be adjusted as desired.

FIGS. 14 through 19 show a reinforcing bar coupler, according to the third embodiment of the present invention. The reinforcing bar coupler of the third embodiment has the same construction and elements as the first embodiment, except that each of a sleeve 2b and a wedge 4b is manufactured to have a constant thickness by plastically deforming a steel plate of a predetermined thickness using a pressing machine. Accordingly, the entire portion of the sleeve 2b has a constant thickness, and semicircular projecting ribs are formed on outer surfaces of seating grooves 24 of the sleeve 2b at positions corresponding to rib seats 26 of the seating grooves 24, thus serving as the latitudinal ribs 24 of the sleeve 2, 2a. Further, the wedge 4b is manufactured by plastically deforming the steel plate using the pressing machine, so that the entire portion of the wedge 4b has a constant thickness. In order to prevent the wedge 4b from being removed from a position between a cover unit 3b and locking parts 27 of the sleeve 2b, a serrated surface 43a is formed on a predetermined portion of a parallel surface 43. Or, an inner surface of each of the locking parts 27 is formed to have a width which is slightly smaller than a width of each of locking parts 45 of the wedge 4b, so that portions of the locking parts 45

adjacent to the leading end 41 are securely locked to the locking parts 27 of the sleeve 2b, thus preventing the wedge 4b from being removed from the sleeve 2b. As shown in FIG. 15, a hammering end 42 of a middle section 47 of the wedge 4b is projected to a direction opposite to the parallel surface 43, thus forming a V-shaped projecting part. The V-shaped projecting part allows a hammering area of the wedge 4b to be increased, thus allowing the wedge 4b to be easily hammered without being hindered by the first and second reinforcing bars 1 and 1a. Further, a steel plate of a constant thickness is cut to have a trapezoidal shape, and then is upwardly bent at both side edges thereof with a pressing machine to form the locking parts 45 of the wedge 4b. A slant surface 46 is formed along each of the locking parts 45 in such a way that a height of the slant surface 46 is reduced from a first end to a second end of each of the locking parts 45. As shown in FIG. 16, a groove 44 having a V-shaped cross-section is axially formed along the middle section 47 of the wedge 4b, so as to reduce a surface area contacting with the cover unit 3b.

The coupling method using the reinforcing bar coupler according to the third embodiment remains the same as the first embodiment.

In the reinforcing bar coupler of the third embodiment, the sleeve 2b is opened at a surface. Therefore, it is possible to manufacture the sleeve 2b by machining a steel plate using the pressing machine, thus

accomplishing mass production of the reinforcing bar coupler and thereby considerably reducing costs of the reinforcing bar coupler.

FIGS. 20 through 24 show a reinforcing bar coupler, according to the fourth embodiment of the present invention. The reinforcing bar coupler of the fourth embodiment couples the first and second reinforcing bars 1 and 1a in a row without lapping ends of the reinforcing bars 1 and 1a. The reinforcing bar coupler includes a sleeve 2c opened at a surface thereof, a cover unit 3c, and a pair of wedges 4c. The general construction and operation of the reinforcing bar coupler of the fourth embodiment remain the same as the first embodiment, except that the first and second reinforcing bars 1 and 1a are coupled in a row. Thus, the reinforcing bar coupler of the fourth embodiment is constructed as follows. That is, a single seating groove 24 is provided along an inner surface of the sleeve 2c, and a single seating groove 31 is provided along a surface of the cover unit 3c, and the wedge 4c comprises a pair of wedges 4c.

Slant surfaces 29 of locking parts 27 of the sleeve 2c are formed to have a diameter which is increased in a direction from a central portion to opposite ends of the sleeve 2c so that the pair of wedges 4c are fitted into the sleeve 2c from the opposite ends having the increased diameter. Since the first and second reinforcing bars 1 and 1a are coupled in a row, the first and second reinforcing

bars 1 and 1a are axially fitted into the sleeve 2c so that leading ends of the reinforcing bars 1 and 1a reach central portions of both the seating groove 24 of the sleeve 2c and the seating groove 31 of the cover unit 3c. On the central portions of the seating grooves 24 and 31 are provided depressions 28 and 34, respectively. Each of the semicircular depressions 28 and 34 has a width corresponding to a width between three latitudinal ribs 12 while is slightly deeper than associated rib seat 26, 32. Therefore, when the leading ends of the first and second reinforcing bars 1 and 1a may be bent during a cutting process using a pressing machine or there may exist projecting parts which have larger diameters than the first and second reinforcing bars 1 and 1a, the depressions 28 and 34 allow the bent leading ends or the projecting parts to be completely received therein, thus allowing the latitudinal ribs 12 of the first and second reinforcing bars 1 and 1a to be completely seated in the sleeve 2c and the cover unit 3c.

A pair of serrated surfaces 33a are formed on opposite ends of a parallel surface 33 of the cover unit 3c. The wedge 4c comprises a pair of wedges 4c, and has a length corresponding to about a half of length of the sleeve 2c. A serrated surface 43a is formed on an end of a parallel surface 43 of each of the wedges 4c.

FIG. 24 shows a reinforcing bar coupler, according to a modification of the fourth embodiment. The reinforcing

bar coupler of FIG. 24 is used to couple deformed bars 1 and 1a which are designed so that latitudinal ribs 12 thereof are staggered each other with respect to associated longitudinal ribs 11, without the necessity of using a cover unit different from the cover unit 3c. The reinforcing bar coupler of FIG. 24 may be applied to couple the deformed bars 1 and 1a to each other, regardless of whether the latitudinal ribs 12 of each of the deformed bars 1 and 1a have a circular or semicircular shape. In order to allow the deformed bars 1 and 1a to be coupled to each other using a single kind of reinforcing bar coupler, the cover unit 3c is manufactured to have a length which is longer than the sleeve 2c by about a half of intervals between the rib seats 32. Further, outside rib seats 32 are provided at opposite ends of the cover unit 31, thus allowing latitudinal ribs 12 of all shapes to be seated in the rib seats 32. Further, the parallel surface 33 of the cover unit 3c is formed to be flat while not being slanted, and the parallel surface 43 of each wedge 4c is also formed to be flat. Thus, when the cover unit 3c is fitted into the sleeve 2c, a position of the cover unit 3c may be adjusted so that the cover unit 3c is axially projected from an end of the sleeve 2c by about a half of intervals between the latitudinal ribs 12. In this case, the pair of wedges 4c are respectively inserted into the sleeve 2c from opposite ends of the sleeve 2c to be placed between the cover unit 3c and the locking parts 27 of the sleeve 2c. At this time,

the pair of wedges 4c are inserted from the opposite ends of the sleeve 2c by the same distance. Thus, the wedges 4c evenly wedge the entire portion of the parallel surface 33 of the cover unit 3c, so that the cover unit 3c sufficiently compresses the outer surfaces of the first and second deformed bars 1 and 1a seated in the sleeve 2c. Thereby, the first and second deformed bars 1 and 1a are firmly coupled to each other. Further, the deformed bars 1 and 1a, which have the same thickness as the same standard but have latitudinal ribs 12 of different shapes, can be coupled to each other by the reinforcing bar coupler having a single kind of cover unit 3c, so that it is unnecessary to prepare different cover units according to shapes of the latitudinal ribs 12 of the first and second deformed bars 1 and 1a, thus causing convenience for a worker, allowing elements of the reinforcing bar coupler to be easily managed, and allowing the coupling operation to be conveniently carried out.

Although reinforcing bars have the same standard, there may exist little difference in the size of the reinforcing bars according to manufacturing companies. However, the reinforcing bar coupler of the fourth embodiment allows the insert distance of each of the wedges 4c to be adjusted according to a thickness of each of the reinforcing bars, thus allowing the reinforcing bars to be firmly coupled to each other and thereby overcoming problems of the conventional reinforcing bar coupler using

the cover unit.

The operation of the reinforcing bar coupler according to the fourth embodiment will be described in the following in detail.

The first reinforcing bar 1 is fitted into the sleeve 2c while the worker confirming that the leading end of the first reinforcing bar 1 reaches the depression 28 of the sleeve 2c or not. At this time, the position of the first reinforcing bar 1 is adjusted so that the latitudinal ribs 12 of the first reinforcing bar 1 are seated in the rib seats 26 of the seating groove 24. Next, the second reinforcing bar 1a is fitted into the sleeve 2c in the same manner as the first reinforcing bar 1. Thereafter, the cover unit 3c is axially fitted into a space between the sidewalls 25 of the sleeve 2c from an end of the sleeve 2c in such a way that the latitudinal ribs 12 of the first and second reinforcing bars 1 and 1a are seated in the rib seats 32 while an end of the cover unit 3c is slightly projected from the sleeve 2c or corresponds to the end of the sleeve 2c. Subsequently, the leading ends 41 of the pair of wedges 4c are aligned with the opposite ends of the sleeve 2c, and then the wedges 4c are fitted into the sleeve 2c from the opposite ends of the sleeve 2c using a hammering tool or a hydraulic tool so that the locking parts 45 of the wedge 4c are securely locked to the locking parts 27 of the sleeve 2c. At this time, the slant surfaces 29 of the locking parts 27 of the sleeve 2c are in close

contact with the slant surfaces 46 of the locking parts 45 of the wedge 4c to strongly compress the cover unit 3c toward the outer surfaces of the first and second reinforcing bars 1 and 1a, so that the first and second reinforcing bars 1 and 1a are firmly coupled to each other. Further, the serrated surfaces 33a of the cover unit 3c engage with the serrated surfaces 43a of the pair of wedges 4c, respectively, thus preventing the wedges 4c from being removed from the sleeve 2c.

In the reinforcing bar coupler according to the fourth embodiment where the pair of wedges 4c are fitted into the sleeve 2c from the opposite ends of the sleeve 2c, each of the wedges 4c has a length corresponding to about a half of a length of the sleeve 2c. When it is assumed that the slant surface of the fourth embodiment has the same slant angle as a slant surface of the fifth embodiment which will be described hereinafter, the thickness of the hammering end 42 of each locking part 45 may be thinner and the depth of inserting each wedge 4c into the sleeve 2c may be shorter, compared to the fifth embodiment where a length of a wedge 4d is almost equal to that of the cover unit 3d. Thus, the reinforcing bar coupler of the fourth embodiment allows the hammering operation to be easily carried out. Further, the reinforcing bar coupler of the fourth embodiment is suitable for coupling thick reinforcing bars to each other.

FIGS. 25 through 30 show a reinforcing bar coupler,

according to the fifth embodiment of the present invention. The general construction of the reinforcing bar coupler of the fifth embodiment remains the same as that of the fourth embodiment. The reinforcing bar coupler of the fifth embodiment couples first and second reinforcing bars 1 and 1a to each other using a sleeve 2d opened at a surface thereof, a cover unit 3d, and a single wedge 4d. In the reinforcing bar coupler of the fifth embodiment, a slant surface 29 of each of locking parts 27 of the sleeve 2d has a constant slant angle from a first end to a second end of each of the locking parts 27, different from the reinforcing bar coupler of the fourth embodiment where the slant surfaces 29 are formed to have a diameter which is increased in a direction from a central portion to the opposite ends of the sleeve 2c. However, the general construction of the cover unit 3d remains the same as that of the cover unit 3c of the fourth embodiment, except that a serrated surface 33a is formed on an end of a parallel surface 33. According to the fifth embodiment, the wedge 4d comprises a single wedge having a length which is almost equal to the cover unit 3d, and a slant surface 46 of each of locking parts 45 has a constant slant angle from a first end to a second end of each of the locking parts 45 so as to correspond to the slant surface 29 of the sleeve 2d. Therefore, as the wedge 4d is fitted into the sleeve 2d, the cover unit 3d compresses outer surfaces of the first and second reinforcing bars 1 and 1a.

The reinforcing bar coupler having only a single wedge 4d is applied to a case where each of the first and second reinforcing bars 1 and 1a has a relatively small diameter. As such, in case where each of the first and second reinforcing bars 1 and 1a has a relatively small diameter, a long sleeve 2d is not required, different from the sleeve 2c of the fourth embodiment. Thus, the first and second reinforcing bars 1 and 1a having a smaller diameter may be coupled to each other using only a single wedge 4d, without the necessity of inserting a pair of wedges into the sleeve from opposite ends of the sleeve. The smaller the diameter of each of the first and second reinforcing bars 1 and 1a, the shorter the length of the sleeve 2d. The reinforcing bar coupler of the fifth embodiment needs a single wedge 4d, thus reducing the number of elements.

FIGS. 29 and 30 show a reinforcing bar coupler according a modification of the fifth embodiment. The reinforcing bar coupler is used to couple deformed bars 1 and 1a which are designed so that latitudinal ribs 12 thereof are staggered each other with respect to associated longitudinal ribs 11, using a single kind of cover unit 3d. The reinforcing bar coupler may be applied to couple the deformed bars 1 and 1a to each other, regardless of whether the latitudinal ribs 12 of the deformed bars 1 and 1a have a circular or semicircular shape. The reinforcing bar coupler allows the deformed bars 1 and 1a to be coupled to each other using a single kind of reinforcing bar coupler

3d. The operational principle of the reinforcing bar coupler remains the same as that of FIG. 24.

The operation and coupling sequence of the reinforcing bar coupler according to the fifth embodiment remain the same as the fourth embodiment, except that the reinforcing bar coupler of the fifth embodiment has a single wedge 4d. Thus, according to the fifth embodiment, the wedge 4d is fitted into the sleeve 2d from an end of each locking part 27 having a larger diameter, using the hammering tool or the hydraulic tool, thus allowing the first and second deformed bars 1 and 1a to be firmly coupled to each other.

FIGS.31 through 35 show a reinforcing bar coupler according to the sixth embodiment of the present invention. The general construction and elements of the sixth embodiment are equal to the fifth embodiment, except that each of a sleeve 2e and a wedge 4e are manufactured to have a constant thickness by plastically deforming a steel plate of a predetermined thickness using a pressing machine. Thus, the entire portion of the wedge 2e has a constant thickness. A plurality of rib seats 26 are formed along the wedge 2e by a press mold, and a plurality of semicircular projecting parts are formed on an outer surface of the sleeve 2e at positions corresponding to the rib seats 26 so as to serve as the latitudinal ribs 22. Further, the wedge 4e is manufactured by plastically deforming the steel plate using the pressing machine so that a thickness of a middle

section 47 is equal to a thickness of each of locking parts 45. In order to prevent the wedge 4e from being undesirably removed from an insert position between a cover unit 3e and locking parts 27 of the sleeve 2e, a serrated surface 43a is formed on a parallel surface 43 or each of the locking parts 27 of the sleeve 2e contacting with a leading end 41 of the wedge 4e is formed to have a width which is slightly smaller than a width of each of the locking parts 45 of the wedge 4e so that the locking parts 27 of the sleeve 2e are securely locked to locking parts 45 of the wedge 4e. As shown in FIG. 32, a hammering end 42 of the middle section 47 of the wedge 4e is projected to a direction opposite to the parallel surface 43 of the wedge 4e, thus forming a V-shaped projecting part. Such a projecting part allows a hammering area of the wedge 4e to be increased, thus allowing the wedge 4e to be easily hammered. Further, a steel plate of a constant thickness is cut to have a trapezoidal shape, and then is upwardly bent at both side edges thereof with a pressing machine to form the locking parts 45 of the wedge 4e. A slant surface 46 is formed along each of the locking parts 45 in such a way that a height of the slant surface 46 is reduced from a first end to a second end of each of the locking parts 45.

As shown in FIG. 33, a V-shaped groove 44 is axially formed along the middle section 47 of the wedge 4e, so as to reduce a surface area contacting with the cover unit 3e.

The bar coupling method using the reinforcing bar

coupler according to the sixth embodiment is equal to the fifth embodiment.

Further, a scale rule 48 is provided on an outer surface of the middle section 47 of the wedge 4, 4a, 4b, 4c, 4d, 4e to extend from the hammering end 42 to a predetermined position. Thus, when reinforcing bars of the same standard which are produced by the same manufacturing company are coupled to each other, the scale rule 48 allows the wedge 4, 4a, 4b, 4c, 4d, 4e to be inserted to a predetermined position in the sleeve 2, 2a, 2b, 2c, 2d, 2e. The subsequent coupling operation is carried out so that the wedge 4, 4a, 4b, 4c, 4d, 4e is inserted to a predetermined position in the sleeve 2, 2a, 2b, 2c, 2d, 2e using the scale rule 48. Thus, the scale rule 48 allows the uniformly coupled reinforcing bars to be obtained, in addition to ensuring an easy post-inspection.

The elements of the reinforcing bar coupler according to the present invention may be selected out of cast steel, cast iron, a steel sheet, high-strength plastic, a special alloy, etc. considering suitability, manufacturing costs, and others. Further, the elements may be processed through several processes including casting, forging, press process, and injection molding, considering a material and workability.

Industrial Applicability

As described above, the present invention provides a reinforcing bar coupler which includes a sleeve opened at a surface thereof, a cover unit, and a wedge, thus allowing reinforcing bars to be promptly and conveniently coupled to each other, and allowing the coupled part of the reinforcing bars to have a high strength.

In the reinforcing bar coupler, the reinforcing bars are coupled to each other by fitting the wedge into the sleeve opened at a surface thereof, thus allowing the coupling operation to be promptly carried out, and allowing the coupled part of the reinforcing bars to have a high strength, therefore reducing building costs and shortening construction period.

According to the reinforcing bar coupler of the present invention, some of elements may be manufactured by a steel plate using a pressing machine, thus allowing a mass production of the reinforcing bar coupler and thereby reducing costs of the reinforcing bar coupler.

According to the present invention, the reinforcing bar coupler allows the reinforcing bars to be coupled to each other while ends of the reinforcing bars are lapped along certain lengths thereof. In this case, the coupled part of the reinforcing bars has a stronger strength and the overlap length of the reinforcing bars is shorter, compared to a case where reinforcing bars are coupled to each other by binding wires, thus allowing distances of adjacent coupled reinforcing bars to be increased and

thereby allowing pouring operation of concrete into space between the coupled reinforcing bars to be easily carried out, therefore increasing a strength of a reinforced concrete structure.

The reinforcing bar coupler of this invention is capable of coupling reinforcing bars which have the same standard but may have little difference in the size of the bars. Further, the reinforcing bar coupler is capable of coupling reinforcing bars to each other, if only the reinforcing bars have the latitudinal ribs of the same shape regardless of whether the latitudinal ribs of the reinforcing bars have a circular or semicircular shape.

The reinforcing bar coupler of the present invention allows elements of the reinforcing bar coupler to be manufactured through a simple process, thus reducing manufacturing costs.

According to the present invention, the reinforcing bar coupler includes a scale rule at a predetermined portion of a wedge, thus allowing the wedge to be inserted to a predetermined position of a sleeve, therefore allowing allows uniformly coupled reinforcing bars to be obtained, in addition to ensuring an easy post-inspection.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the

invention as disclosed in the accompanying claims.